THE APPLICATION OF INVESTIGATIONAL DATA TO THE REORGANIZATION OF THE FARM.[1]

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Farm management investigations, and I take it that I am to limit my discussion largely to such, reach back not more than two decades. The early work of Roberts, Hunt, Bailey and Warren, of Cornell University, which was developed along the line of agricultural surveys and financial records of one kind or another, is not yet two decades away. The work of W. M. Hays, and others in Minnesota, along the line of discovering the unit factors of cost in production, dates back only to 1902 and their work of developing farm plans and methods of crop rotation, as applied to farm organization, only a little farther. Yet these are the pioneers in farm management investigation. Any data now used in the organization or reorganization of farms are pretty likely to trace back, in their inception, to one or the other of these sources.

Because of the meagerness of reliable and accurate data relating to the farm business prior to 1910, very few attempts were made to organize the farm business. With the growth of the investigational work, however, and with the definite recognition in 1910 of farm management as a field for instruction and investigation, there came a decided awakening to the possibility for farm organization. The methods of analyzing the farm business as worked out by Dr. G. F. Warren and his colleagues at Cornell University, in coöperation with Dr. W. J. Spillman and others of the Federal Department of Agriculture at Washington, have been widely used in studying farm organization. They provide many excellent suggestions for measuring farm profits, for comparing relative profits from different enterprises, and for improving and stabilizing farm operations. The unit factors of cost and the labor requirements worked out in some of the states also have proven of value in developing plans for the organization of profitable farming. Investigations made in various states have supplemented and enlarged upon these early investigations and each has contributed data of value in farm organization.

[1] Paper read at the tenth annual meeting of the American Farm Economic Association, Chicago, Illinois, November 11, 1919.

The Kind of Data to Apply.

I have been unable to devise a better way of indicating how investigational data may be applied in the reorganization of farms than to discuss the available data in connection with definite steps in the process of farm organization. I should emphasize first perhaps the importance of using only data secured under conditions normal to the type of farming that is being considered. The data also should be based on sufficient records or measurements to overcome radical variations or individual practices. Data taken from single farms, from overcapitalized farms, or from institutional farms supported by public funds, are of little use in determining correct farm practices for a community or group of farms. It is true that the record of a very exceptionally well-organized and profitable farm can be used to demonstrate a principle or to illustrate an idea or plan of organization. But data taken from a large group of good and poor farms, as normally operated, reflect in a far truer way, the average results that are likely to be obtained and that can more safely be used as base data in farm organization. An exceptionally profitable farm or an exceptionally well-organized farm, so far as capital distribution, labor employment, and equipment are concerned, may serve as an ideal toward which to work. Such a farm often provides the inspiration which leads toward better organization. Choosing data for use in the reorganization of a farm is much like writing a prescription for a sick person. Much depends on the nature of the ailment and something on the remedies available.

Problems in Farm Organization.

The problems in farm organization to which investigational data should be applied are best indicated by the inquiries of farmers who have farms that they wish to organize. They are often brought to our attention by the inquiries of the city man who is a prospective farmer and who wishes to know how to organize a farm. One of the first questions usually propounded is in regard to capital investment. How should my capital be distributed in land, buildings and operating capital? With a given amount of capital would it be best for me to buy a farm or would it be best for me to buy equipment and rent a farm for a time? How large a farm should I buy? What enterprises can be combined most profitably? These, and many similar inquiries, indicate the type of information desired by the man who wants to organize a farm. As a basis for answering the inquiries we

have a considerable mass of data taken from farm management surveys in various states. Bulletin No. 295 of Cornell University was the first to give any data bearing specifically on these questions. Table VII. of this bulletin brings out clearly the fact that capital has a considerable part to play in the earning of profits from farming. It shows that the labor income of the farmer increases consistently as the capital investment increases. While the data do not tell just how much capital should be invested in a farm, they do establish the principle that a reasonably large capital investment is more likely to give a larger labor income than a small capital investment. These data are supported by the results obtained in a survey made in Indiana, Illinois and Iowa and reported in bulletin No. 41, Bureau of Plant Industry, U. S. Department of Agriculture. This principle has been confirmed by numerous surveys made in other states and almost without exception leading to the same results. The principle therefore, which is based on investigational data, can be applied safely in giving advice regarding investments in farms.

Ideas about the proper size of farm have been revolutionized since farm management surveys were made. The old idea was that farms were too large, that a small farm well tilled paid better than a large one. That this was largely an assumption is shown by data submitted originally in Bulletin No. 295 of Cornell University, again supported by data in Bulletin No. 41, U. S. Department of Agriculture, and confirmed by numerous other surveys. Table XXVII., Cornell Bulletin No. 295, brings out clearly the fact that farms of small size returned small labor incomes, and that there was a consistent increase in labor income as the farms increased in size. This holds true at least up to an average size of 261 acres. Data in Bulletin No. 41, U. S. Department of Agriculture, indicate that labor incomes increase as farms increase in size to 623 acres. Whether or not the labor income would continue to increase as farms increased in size above this figure has not been so clearly demonstrated. There are a number of instances, recorded, however, where larger farms have paid larger incomes. The data available would indicate that up to within reasonable limits one is safe in assuming that other things being equal the larger the farm the larger the labor income, under good management.

The principle is also established in farm management surveys that it is good policy in the organization of a farm to limit the amount of money invested in buildings unless they are used for productive purposes, and that the larger proportion of capital can well be invested in land of good quality with a generous proportion reserved for operating

expense. These three principles are perfectly safe to use in the organization of a farm. They are based on investigational data from many states and are drawn from averages of large numbers of farms which are operated under normal conditions. While the exact scientist may feel that these are not accurate investigational data, it must be admitted that they serve the same purpose and that they are of direct value in planning the reorganization of a farm business and in the investment of capital.

Data on the Farm Layout.

The second question asked, as a rule, is how shall I plan my fields and lay out my farm? Obviously it is difficult to get exact data to apply on such a question when one recognizes the fact that the soil on every farm is different from that on other farms. When one considers the differences in climatic conditions, topography, and in commodity demands, it can be seen that there is no exact answer to the question. As in determining the investment of capital and size of farm, however, there are principles that can be applied. Calculations made by enthusiastic mathematicians and observations made by farm operators have demonstrated the fact that the arrangement of the farmstead and its location has considerable to do with the profitable operation of the farm. It is important that the farmstead be centrally located so as to give easy and direct access to the fields. This saves time and effort on the part of the farmer and his teams, and time is money on the farm if it is any place. Again, observation and data have shown that the arrangement of the buildings on the farmstead, and the grouping together of those in which the work is closely related is important in saving time and labor in performing the farm operations. Data on the subject are meager, to be sure, but the principles have been well established and are generally accepted. Some data covering these points have been published in bulletin form in books on farm management, and in current periodicals.

Field plans and rotation schemes based on crop rotation data are offered in numerous bulletins, and in other publications on crop rotations. Again, it must be admitted that there are no exact data that can be applied to making divisions of farms into fields. Topography, character of the soil, nature of the crops to be grown, and various other factors will govern in this matter. Calculations can be made, however, and principles applied. These relate to the size of the fields, the shape of the fields, though it is not always possible to regulate this, and to the number of fields. The publications mentioned above

are suggestive and offer many good illustrations of how efficient field plans can be developed.

On crop rotation, fortunately, we have considerable helpful data. The investigations made at Pennsylvania State College, at the Ohio Experiment Station, at Illinois, and at Minnesota are especially useful in determining good cropping practices. While the investigations were not originally contemplated as bearing on farm management, perhaps, the fact remains that the data drawn from them are very useful in organizing good crop rotations, and in determining correct farm practices. In planning rotations consideration should be given, of course, to the relative profits from different crops and classes of stock, to the feed supplies needed for the farm, to the cash crops that are desired for sale, and to the maintenance of the fertility of the soil. The conditions governing the first items will vary with the individual farm. The maintenance of fertility, however, is a more universal problem. On this question there are data that can be applied. The data supplied in "Soil Fertility and Permanent Agriculture" by Hopkins, are useful in this connection. While this again is the work of a chemist and was not developed with the specific idea of determining farm management practices, it can be adapted admirably in determining the draft on the soil of the various farm crops. No plan for crop rotation or crop growing on any farm is complete without calculating the probable draft on the soil elements and without making provision for replacing them. This involves estimates of the amount of manure likely to be returned from the livestock, and of the amount of fertilizing material which is contained in the soil. There are data in Hopkins' "Soil Fertility and Permanent Agriculture," or in Van Slyke's book on "Feeds and Fertilizers" that enable one to determine the probable draft on the soil by each of the crops and the total draft by all of the crops; also to determine the amount of fertility returned in crop residues, in manures, and from green manure crops. The differences between the two will show whether the soil is being enriched or impoverished by the schemes of cropping. Such a plan involves considerable calculation, but the results warrant the time and effort expended and will make more probable the adoption of a scheme of cropping that will be conservative of fertility.

Data Applied to Livestock Problems.

Feeding standards have been established by chemists and nutrition experts. It is an easy matter to calculate balanced rations for each class of stock from data worked out on the composition of feed stuffs

by chemists. This is the first step in the process of applying investigational data to the reorganization of livestock enterprises. The next one is to estimate the possible production of feed supplies. This is a matter of calculation of acreages and yields. A knowledge of the yields of the farm to be reorganized is the best basis to work from. Where this cannot be had data can often be taken from a community survey of the vicinity which fairly approximates conditions. The purpose of the calculations is to learn the feed requirements for all classes of livestock to be kept on the farm. Sound farm organization contemplates the production of the bulk of feed supplies on the farm. The question of manures for restoring fertility is quite as closely related to organization as are feed rations and feed supplies. Data covering this phase of the subject are provided in Warren's "Farm Management" and in Hopkins's "Soil Fertility and Permanent Agriculture."

Quite as useful, perhaps, as any data bearing on the livestock questions are those relating to animal units. These data, while arbitrarily established, provide a rough basis of comparison between farms and for determining when a farm is fully stocked. They also enable comparisons between farms as to receipts per unit of productive stock. The density of the livestock population is indicated by the statement of acres per animal unit.

More exact data are available concerning feed requirements per unit of production. Publications from several states now provide tables showing the grain, roughage, silage and pasture units required in making a hundred pounds of milk under farm conditions. Other publications give the grain and grain equivalent required to make 100 pounds of salable hogs. These are taken from records of feeding under farm conditions. Such records give the best possible data to apply in determining the plan for organizing the livestock enterprises of a farm.

Data on Farm Equipment.

Machinery is a large factor in the organization of a modern farm. Over-investment in machinery is possible, but rarely found. Efficient use or full occupation is important in getting returns on machinery investment. It has been well shown in farm surveys that machinery is much more efficiently used on large farms than on small ones. Data on the capacity of machines and of what is a day's work with different implements are very useful in determining the necessity for the purchase of implements. Several publications are now available containing much data that are useful in determining what may be ex-

pected daily of workmen at various kinds of work with implements of various sizes and kinds. The use of power or large-sized machinery or implements in reducing the operating costs in farming is a live question. In farm reorganization it is impossible to avoid consideration of tractors, gas engines and other forms of motive power. Whether or not they can be profitably used depends upon the economics of farm power problems at the time. I am not bold enough to assert that there is yet any data available which truly indicates when mechanical motive power should replace the horse. There are some data bearing on the question, but as yet one should at least use "horse sense" as well as the available data in choosing between the two.

Organizing the Labor Demands.

Labor is the largest single factor in the making of farm products. The efficient use of labor has more to do with successful farming than is usually acknowledged. Careful plans for conserving the energies of man and horse labor are seldom made by farm operators. Yet complaints are heard on every hand that farm labor is scarce and that wages are too high. Because most of the farm labor is performed by the farmer and members of his family it is often expended without regard to the possibility of returns. It is often wasted on enterprises that pay but a small return when it might more profitably be employed on others. Records from successful farms show that profits from farming are largely derived from labor expended on productive enterprises.

In order to use labor wisely it is necessary to know how many hours daily, monthly and yearly may be expected from men and horses. It is also well to know what the monthly, seasonal and annual demands for labor will be. With these facts known it becomes possible to so reorganize the farm enterprises as to efficiently employ the labor at all times. Where labor supplies are limited for a season it may be possible to substitute crops or enterprises for the usual ones that will take less labor or demand labor at an unfilled period. Bulletins on "Labor Requirements of Crop Production," also "Labor Requirements of Livestock" present data which can well be used in studying the labor problems on many farms. With the labor requirements per acre for each operation in the growth of a crop, and the total labor requirements per acre given, it becomes possible to calculate the seasonal and total requirements for the production of crops on the farm in question. Similar data on the annual labor requirements for all classes of livestock give the basis for the calculation of total labor

requirements for crops and stock. To this must be added the maintenance or unproductive labor to get the labor requirements for the farm. The unproductive labor is usually 18 to 25 percent of the total on diversified farms. It has been found to run as high as 42 percent on a large grain farm. When the total labor requirement has been learned it may be compared with the probability of labor from the supply available. Thus an estimate may be made in advance and a labor shortage avoided by the introduction of crops or enterprises demanding less labor. Or, if the indications are that the labor available will not be fully employed, more intensive crops or a larger quantity of livestock can be introduced to give full employment. In this way the labor demands of a farm can be largely reorganized. By the proper choice of crops and livestock enterprises competition for labor can be largely avoided and "peak loads" reduced.

Marketing Data Useful.

Until recently the farmer has been concerned chiefly with production. It is possible that production is still his chief concern. But surely no phase of the farmer's business offers a better opportunity for reorganization than the one which deals with getting his products on the market. Data on seasonal prices and market fluctuations over long periods of years are useful in showing the favorable times for marketing. Statistical studies of world crops, demands and supplies, give information which frequently enables one to hold or to sell to advantage. This is a method of increasing the labor income that has been but little used by farmers. The profits of good management in production may easily be eaten up by poor marketing.

In Conclusion.

It may be said in conclusion that much of the farm management data derived from investigational work would be reluctantly accepted by exact scientists. Yet the principles which have been evolved from agricultural surveys and from cost of production studies seem to hold just as truly as many that are based on exact sciences. The relation of size of farm business, of capital investment, of productivity of crops and livestock, and of efficient direction of labor, to labor income has been demonstrated so often and so clearly by different investigators as to be axiomatic.

These may safely be made a measure of comparison between farms or between a single farm and the average of the farms of the community. Some data are available and can be used in farm reorganiza-

tion that will make farming more systematic and profitable as well as more satisfying to the farmer.

The past twenty years have given some insight into the complexities of farming. But more accurate data as well as more data are needed. The data we have need refining and polishing. New "measuring sticks" are in demand. The old ones should be more finely graduated. Satisfactory recipes for farming cannot well be written until still finer analyses of the farm business can be made. Farm management investigations providing for accurate records over long periods of time and including large numbers of farms will give the basis for such analyses. Farm organization data should be as easily available as data tables on civil engineering or as interest tables. Farming is not and cannot be made an exact science. It can be made less risky, however, by a more accurate knowledge of the ingredient parts and this knowledge can come only from careful investigations.